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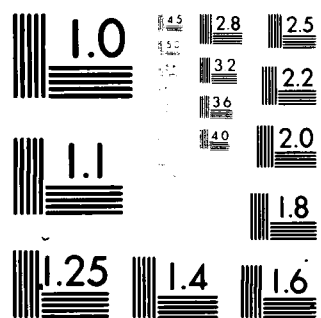
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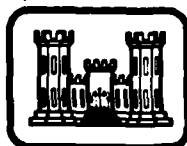
POST OCCUPANCY EVALUATION OF A  
REMOTE AUSTRALIAN COMMUNITY:  
SHAY GAP, AUSTRALIA

R. Bechtel, C.B. Ledbetter and N. Cummings



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Prepared for  
DIRECTORATE OF MILITARY PROGRAMS  
OFFICE OF THE CHIEF OF ENGINEERS  
By



UNITED STATES ARMY  
CORPS OF ENGINEERS  
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY  
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20. (cont).

Bland, off-white interiors allowed residents to express themselves when decorating. Shay Gap was a successful design concept for communities designed for remote areas in either hot or cold regions.

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## PREFACE

This report describes the post occupancy evaluation of a remote mining community in the Australian desert. It is one of a number of detailed architectural-psychological investigations the U.S. Army Cold Regions Research and Engineering Laboratory has made into the habitability of buildings and communities whose inhabitants are contained indoors due to temperature extremes and isolation and have limited contact with the outside world for prolonged periods of time. The adverse weather, both hot and cold, further aggravates the living conditions. Lessons learned have aided design and community planning guidelines used by the military, government, and private business to produce more cost effective solutions to remote habitation.

The investigation was conducted by Dr. Robert Bechtel, psychologist, Environmental Research and Development Foundation, Tucson, Arizona, on contract to USACRREL, C. Burgess Ledbetter, project officer and research architect at USACRREL, and Nancy Cummings, urbanologist and librarian at USACRREL.

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## INTRODUCTION

Shay Gap is a mining town located near a large body of iron ore in Australia's Pilbara district. It was planned and built to be moved when ores were exhausted. The town was designed by architect Lawrence Howroyd, and built by the Goldsworthy Mining Co. Ltd., in 1973. The company plans to move the town in 1980. When it was evaluated in 1977 the town had been operating for over three years.

Shay Gap is a unique mining community because the architect carefully considered the effects of the hostile environment on the residents. The Company knew that it would take more than high salaries to hold men in the Pilbara, so it wanted to create an attractive community, not easy in a locale with winds of up to 224 kph (140 mph), temperatures as high as 82.2°C (180°F), and only 11.3 cm (5 in.) of rain per year.

Howroyd studied communities in the Middle East where adaptation to a similar environment had developed over hundreds of years. He found that a major response to the desert environment was to build a wall around the community. The wall had both a physical and symbolic function. It provided shade and symbolically separated the community from the hostile environment. Within the wall, houses were crowded together to shade one another, creating narrow streets and forcing people into close social contact.

The medieval communities of the Middle East, however, did not have to accommodate the automobile in their narrow streets. The automobile appeared to interfere with this solution. Howroyd decided to eliminate the automobile. He felt that automobiles were dangerous and disruptive, threatening children and worrying mothers.

Shay Gap was therefore designed as a walled community, with clustered housing and automobiles only on the perimeter. These concepts were discussed in an article in Time magazine on 9 June 1975. This article drew the attention of researchers from the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), for the principles incorporated in Shay Gap's design are similar to those recommended for cold regions communities (Zrudlo 1972, Australian National Commission for UNESCO 1973). In late May and early June 1977, researchers from CRREL visited Shay Gap and evaluated Howroyd's design.



Figure 1. Shay Gap, Australia.

A photograph of Shay Gap, showing housing and administration buildings appears in Figure 1. Figure 2 is a plan of the site.

#### METHODS

The post occupancy evaluation of Shay Gap was conducted in three phases. In the first phase, the researchers visited the architect and mining company officials to obtain design hypotheses, essentially a list of the design decisions made by the architect that related design elements to human behavior.

In the second phase, a questionnaire was constructed that would directly test the design hypotheses with the responses of residents living in the town.

In the third phase, CRREL personnel conducted a behavior setting survey of the community to further test the design hypotheses and provide quantitative data so that Shay Gap could be compared with other communities studied (Bechtel and Ledbetter 1976, Bechtel 1977).

#### First phase - design hypotheses

We obtained the design hypotheses from visits with Lawrence Howroyd at his offices in Perth, Western Australia, and with officials of the Goldsworthy Mining Company in the same city. This task was relatively easy because Howroyd had given considerable thought to each of his design

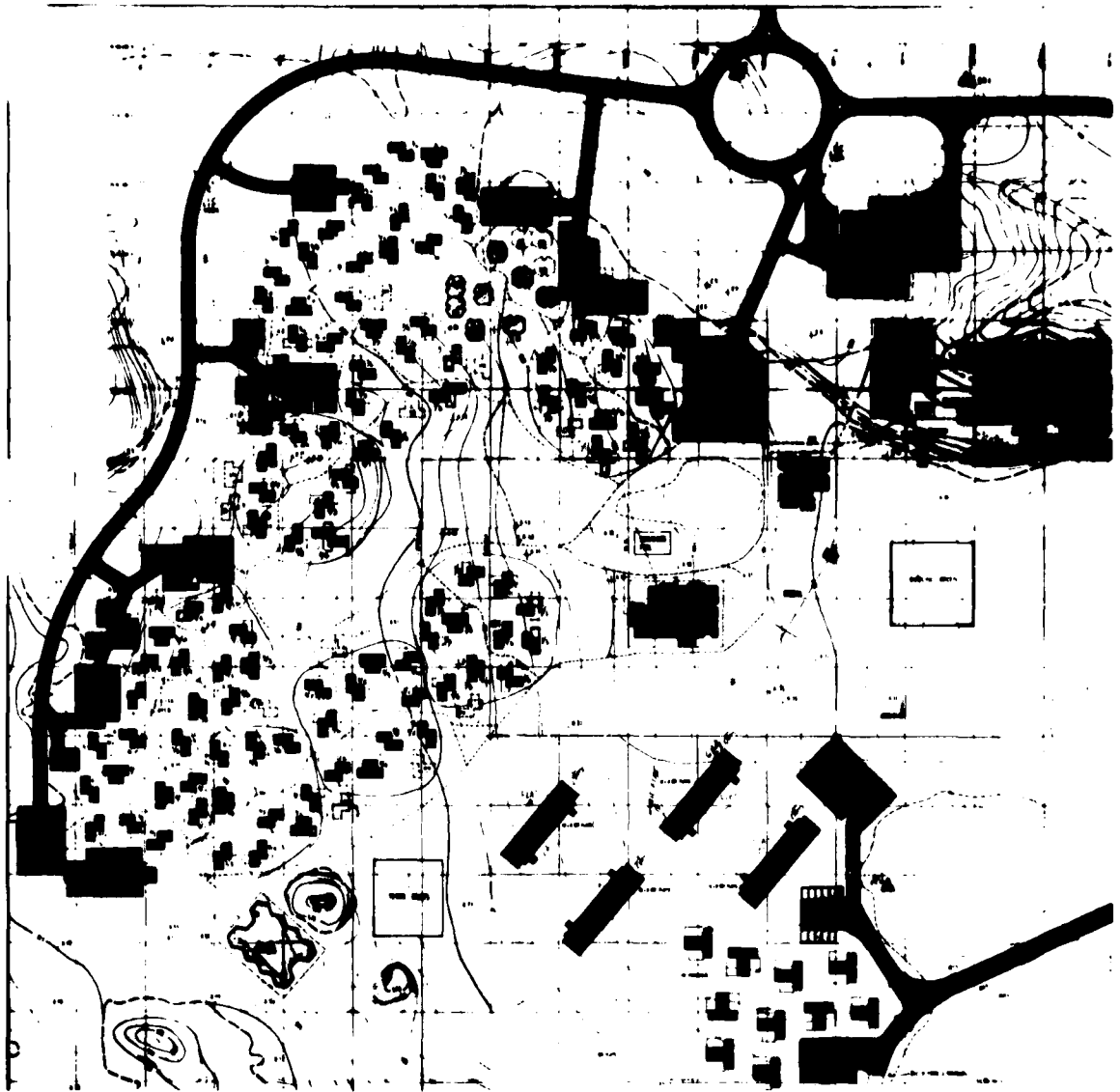


Figure 2. Town plan of Shay Gap.

decisions. The range of decisions stretched far beyond the three principles previously discussed. A list of 55 hypotheses was derived from these conversations (Table 1).

Table 1. List of design hypotheses for Shay Gap\* as expressed by architect.

Social factors

1. There is no way to satisfy human needs in a one-company town.
2. Company life is divided between the "haves" and "have-nots."

\* See Appendix D for results bearing on each hypothesis.

Table 1. (Con't)

3. An isolated community does not have to be like a normal society.
4. In Shay Gap mothers should have less fear of their children getting run over by automobiles.
5. The climate is more of a fear than cars for mothers at Shay Gap.
6. Cars being kept away has increased social interaction.
7. When a town has a population of under 1,000, everyone recognizes everyone else.
8. People want to walk more at Shay Gap than elsewhere.
9. There are four levels of territoriality in a community:
  1. The lockable private areas inside the house.
  2. The transition areas belonging to the family of the house.
  3. The local common areas.
  4. The community's common areas.
10. The school should be a "crucible" for the community.
11. Children bring families together.
12. The school should be a community building.
13. There is no difference in satisfaction between an open and closed town.
14. Single men's quarters should be mixed with family housing.
15. Separating single men from families precludes a cohesive community.
16. In the desert of Australia, men lose their libidos in 3 months.
17. There will be too many single men in Shay Gap.
18. All services should be grouped together to create a focal point.
19. Grouping too many services in one place does not work.
20. The houses are too close together in Shay Gap.
21. People want to be able to look at the horizon.
22. People at Shay Gap cannot have parties without disturbing their neighbors.
23. Most people would rather be in an air conditioned home or in a bar than in other places.

Table 1 (Con't).

24. Knowledge that the town will be moved in 1980 will create a feeling of impermanence.

Housing and environmental factors

25. The hills around Shay Gap create a feeling of confinement or security.
26. The houses at Shay Gap exceed the norm for single family housing.
27. The townsite may be too small.
28. There has to be a minimal population before a satisfactory level of services can occur (about 9,000 to 25,000).
29. The noisy plumbing at Shay Gap invades privacy.
30. The inability to open windows is a problem to residents.
31. There is no satisfactory place in Shay Gap for an individual to do major car repairs.
32. The house is an integral part of the community.
33. The community should be far enough from the mine to eliminate the dust problem.
34. The community should be sheltered from the wind and blowing sand.
35. People need to be enclosed.
36. Cars can be kept away from houses without serious problems.
37. All activities should take place within screened areas.
38. A community will accept identical houses.
39. Children play in undefined areas, not playgrounds.
40. All house openings should face the courtyard so residents can look out, but outsiders cannot look in.
41. All windows and houses should face the center of a cluster, to create a common space.
42. Bland white interiors enable people to express their own personality.
43. The roof overhang will shade the house twice a day.
44. Women will confine themselves to air conditioned areas.

Table 1 (Con't)

45. There is too much noise within each cluster.
46. People at Shay Gap will not believe they are as crowded because they are in the desert.
47. Shay Gap is the end-of-the-line in isolation. People there feel cut off from the mainstream of life.
48. The "clean areas" in Shay Gap will be noticeably cleaner than those in other mining towns.
49. Clean areas will be inconvenient.
50. People will not like the housing design at Shay Gap.
51. People will not like the sliding front door.
52. The lack of a tub will be an inconvenience.
53. Pets will create problems because no space is allowed for them.
54. There is a lack of space for gardens.
55. Outdoor and indoor storage is inadequate.

Given this rather exhaustive list of hypotheses and problems, it is apparent that many are related. A solution to one problem may be an answer to others as well. Houses that are too close together (20) will cause the clusters to be too noisy (45), inhibit parties, (22), and not leave enough room for gardens (54) and pets (52).

Similarly, because many variables are related, it is not always possible to define the cause of a given response. People at Shay Gap may indicate that they interact more with other people (6), attributing this to the lack of cars, but it may also be due to the closeness of housing and the narrow pathways. Appendix D lists results related to each hypothesis.

Second phase - construct a design questionnaire.

Recognizing the above limitations in testing the design factors and problems, we constructed a questionnaire that would attempt to answer these hypotheses by asking the resident to compare conditions at Shay Gap to those in other communities where he had recently lived. For example, the resident was asked if the wind at Shay Gap, compared to the wind in other communities where he had recently lived, was

Least in volume and annoyance  
Less than most  
The same  
More than most  
The most of any place.

Each answer was assigned a numerical value between 1 and 5 with "least in volume and annoyance" rated 5, and "the most of any place" rated 1. When all the answers were added together, a low score would be least favorable to the environment of Shay Gap, while a high score would be most favorable. These answers obviously depend on the nature of the last place the resident had lived.

The design questionnaire is reproduced in Appendix B. It was divided into questions about site, community, social and daily living, children, and the house. The questionnaire was administered to a random sample of mining employees living in the residential sections of Shay Gap. Contract employees who were handling the food services were excluded from the sample.

The housing register as of 30 April 1977 was used as the list of subjects for the sample. We wanted to interview 50 subjects, thus 58 were sampled from a list of 173 residences, including families and singles. Either the wife or husband, or both, were interviewed in cases of families. Forty-four questionnaires were completed. Those not interviewed were on vacation or leave during the survey period. No subjects refused to be interviewed.

The single men's quarters (not part of the housing complex) were also sampled. From a list of 345 single men and 12 single women, 45 were drawn as a sample and 29 completed interviews. In all, 73 people completed interviews.

#### Third phase - conducting a behavior setting survey.

The behavior setting survey was developed by Barker (1968). It originally took one year to complete. The technique has now been developed into a questionnaire format (Bechtel 1977), so it can be administered in the short time a questionnaire survey takes. The procedure of the behavior setting survey is to divide up all behavior that takes place in a community into behavior settings. These are common places and events that are frequented or occur in everyday life. Grocery stores, gas stations, barber shops, and law offices are behavior settings, as are parties, basketball games, Boy Scout meetings, and school classes. Any behavior pattern that is tied to a place and regularly repeats itself is a behavior setting. Behavior settings continue even if the people in them change. Behavior settings are useful because they are tied to the environment. An architect who knows the behavior that will take place can design an environment to accommodate it.

A behavior setting survey is conducted by asking the people in charge of settings about numbers of people attending, times of operation, and details of daily behavior. Behavior in settings is measured in terms of action patterns, behavior mechanisms, leadership roles, general richness, welfare and pressure ratings, and autonomy.

Action patterns are the kinds of general behavior that take place during a day. There are eleven action patterns, scored as a percentage of occupancy time. Occupancy time is the total number of man hours in

a setting during a year. If a grocery store has an average of 20 customers at any time during a day, has 2 clerks, and is open 220 8-hour days, its occupancy time is  $(2+20) \times 8 \times 220$ , or 28,720 hours.

An action pattern would be scored as a percentage of the occupancy time. For example, aesthetics action pattern is scored when behavior is directed toward cleaning up the environment or improving its appearance. If the clerks spend one hour a day cleaning the store and one hour a week making displays, then 440+110 hours a year, or only 1% of the time ( $\frac{550}{28,720}$ ) is spent in aesthetics action pattern. Percentages are coded as follows:

1 - 10%	1
11 - 20	2
21 - 30	3
31 - 40	4
41 - 50	5
51 - 60	6
61 - 70	7
71 - 80	8
81 +	9

The business action pattern is scored when actual buying and selling occurs. The education action pattern is scored when formal teaching and learning occur, as in a school classroom. The government action pattern is scored when the behavior has to do with government at any level. The nutrition action pattern is scored when eating, drinking, or preparing food or drink occur. The personal appearance action pattern is scored when behavior is concerned with improving personal appearance, such as getting dressed up or grooming. The physical health action pattern is scored when behavior is concerned with physical health. The professionalism action pattern is scored when the leaders in a setting are paid for what they are doing. The recreation action pattern is scored when behavior is for immediate enjoyment. The religion action pattern is scored when behavior has anything to do with religion, for example, prayer and religious ceremonies. The social contact action pattern is scored when interpersonal relations of any kind take place.

Behavior mechanisms are another form of behavior measured in behavior settings. Behavior mechanisms deal with how people use their bodies in settings, for instance talking, walking, using their hands, and thinking. The affective behavior mechanism is scored when people express emotion, such as crying or laughing. The gross motor behavior mechanism is scored when large muscles of the body are used, such as in walking or running. The manipulation behavior mechanism is scored when hands are used in any way. Talking is scored when verbal expression is heard. Thinking is scored when problems are solved or decisions made.

Behavior mechanisms are scored and coded as a percentage of total occupancy time in the same manner as action patterns.

Welfare and pressure ratings measure the climate of acceptance of children and adolescents in a setting and in the community as a whole.



Pressure is a score indicating whether the presence of a child or adolescents is 1) required, 2) urged, 3) invited, 4) neutral, 5) tolerated, 6) resisted, or 7) prohibited. Welfare is scored by whether the setting is 0) not concerned with children or adolescents, 1) serves children or adolescents, 2) provides for children elsewhere, or 3) has children serving other members.

Autonomy measures the level at which decisions are made affecting the daily lives of people in the community or in specific behavior settings. Autonomy is rated by assigning levels to where decisions are made. Four kinds of decisions are measured: where it is decided who can enter the settings, where it is decided what the fees and prices of a setting are, where it is decided what the program or rules of a setting are, and where it is decided who the leaders of a setting are. If the decision is made at the national level in Canberra, it is assigned a 1; if at the state level in Perth, a 3; if at the district level of the Pilbara, a 5; if at the company level in Port Hedland, a 7; if at Shay Gap itself, a 9. Nine is the highest autonomy level.

Leadership roles are measured by a system with six ratings called penetration levels. The level 6 is assigned to any setting that has a single leader who is indispensable to the setting. Most leadership roles are at a 5 level, which is called shared leadership. In these settings, if one leader is not available, another can take his place. A 4 is assigned to people who are not top leaders but who have roles such as secretary, treasurer, etc. People at the 4-5-6 levels are called performers.

Members of behavior settings not in the 4-5-6 levels are called nonperformers. Members are people who are generally in a setting, but do not exercise leadership, such as children in school. They are at the 3 level. An invited audience or guest is at the 2 level, and mere onlookers are at the 1 level. Penetration levels are assigned to the population groups present, according to age, sex, and race.

Action pattern scores, behavior mechanism scores, and the highest penetration level of various population groups found in a setting are added together and multiplied times a coded occupancy time to give a general richness index, or GRI. The formula is as follows:

$$GRI = \frac{(ApR + BmR + PenR) C^{OT}}{100}$$

where

ApR = Action Pattern Ratings

BmR = Behavior Mechanism Ratings

PenR = Penetration Level Rating  
for Population Groups

C<sup>OT</sup> = Coded Occupancy Time

Since occupancy times are such large numbers, they are coded into more manageable one and two digit numbers (see Barker 1968, Appendix I).

The GRI indicates a level of behavioral resource in a behavior setting or a community. A high GRI indicates a location with many different kinds of behavior, many different kinds of people, and many hours of occupancy time. It is often typified by the popular phrase "where things are happening."

A questionnaire was constructed that would gather data for these measurements. It is reproduced in Appendix B. This questionnaire was administered to 45 of the same families and single men sampled for the design questionnaire to provide information on the family and single residences.

Behavior setting data from public settings, such as the recreation activities, administration, dining, etc., were collected in formal interviews that followed the same kind of format as the private setting interviews. These data were then compiled and scored for the various behavior scales mentioned above.

#### RESULTS\*

##### Design questionnaire (see Appendix B)

##### Site

##### 1. Were the surrounding hills comforting?

Respondents were asked to rate the surrounding hills on a 1-5 scale, a five being the most favorable reaction to the hills. Thirty-four, or 47%, chose the 5th category, that the hills were comforting and protective. Thirty (41%) were neutral, and only two (3%) were negative. The mean reply was 4.15 with a standard deviation of 0.94.

In a follow-up question, 46 (63%) said they preferred hills to a visible horizon.

##### 2. Was the wind least in annoyance?

Twenty-seven (37%) replied that the wind was less annoying than in most places they had lived, while fifteen (21%) were negative. The mean was 3.62, with a standard deviation of 1.26.

##### 3. Was the dust least in annoyance?

Twenty-three (32%) felt it was less than most. Twelve (16%) were negative. The average reply was 3.37, with a standard deviation of 0.97.

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\* Note again that these results are related directly to design hypotheses in Appendix D. Appendix C lists the chi square test for each question's answers.

4. Space in Shay Gap?

Twenty-nine (40%) felt it was less than most. Only nineteen (26%) were positive. The mean was 2.55, the standard deviation 1.26.

5. Shade in Shay Gap?

Twenty-nine (40%) said that it was better than most. Nineteen (26%) felt it was worse than most, or worst of all. The mean response was 3.23 with a standard deviation of 1.01, indicating the response did not differ from neutral.

In a follow-up question as to what caused the shade, ten (27%) attributed it to the vegetation and twelve (16%) attributed it to the roof line.

6. Isolation in Shay Gap? (This question reverses the coding order, so that five will remain the most positive answer.)

Thirty-eight (52%) claimed Shay Gap was the most isolated of the communities in which they had lived. The mean response was 2.11, with a standard deviation of 1.31.

7. Permanency of Shay Gap?

Thirty-four (47%) claimed Shay Gap was the least permanent of any place they'd lived. The mean response was 2.41, the standard deviation 1.65.

Community

8. Groceries and store goods available?

Twenty-one (29%) answered that the availability of groceries and store goods was average, and the same number answered that it was worse than most. Twenty (27%) felt it was the worst of any place they had lived. Mean response was 2.33, with a standard deviation of 1.07.

9. Are the houses too close together (reversed coding)?

Probably because houses in clusters average 12 feet apart (at angles), forty-four (60%) felt the houses were the closest together of any place in which they had lived recently. The mean was 1.79, with a standard deviation of 1.14.

10. Do you go outside Shay Gap to buy things (reversed coding)?

Twenty-two (30%) felt that Shay Gap was average in this respect, and the mean of 2.67 with a standard deviation of 1.28 indicates only a very slight tendency to feel it was better than most.

11. Shopping center?

Thirty (41%) felt the shopping center was average. A mean of 2.94 and a standard deviation of 0.98 indicate a fairly even distribution on this issue, with twenty-two favoring, thirty neutral, and twenty-one disliking the shopping center.

12. Space for pets?

Twenty-eight (38%) felt that the amount of space for pets in Shay Gap was worse than most places in which they had lived recently. The mean was 3.49 with a standard deviation of 1.24.

13. Storage space?

a. Outdoor

Thirty (41%) felt that outdoor storage space was worse than most places in which they had lived recently. The mean was 2.29 with a standard deviation of 1.07.

b. Indoor

Twenty-six (36%) felt that indoor storage space was better than most places in which they had lived recently. The mean was 3.49 and the standard deviation 1.24.

14. Space for gardens?

Twenty (27%) felt the space for gardens was average, while the same number felt it was better than most. The mean, however, was 2.73 with a standard deviation of 1.13, indicating a negative trend.

15. Number of clean areas?

Twenty-seven (37%) felt the clean areas were better than most but a sufficient number, twenty-three (32%) felt they were average. The mean was 3.69 with a standard deviation of 0.88, indicating a favorable trend.

16. What building is most used?

Thirty (41%) mentioned the shopping center, but a significant number, twenty-eight (38%), mentioned the club. The mess, the medical center, and the vet canteen were mentioned by four, one, and one persons respectively.

17. Most popular recreational activity?

Thirty-one (42%) listed drinking at the club as the most popular recreational activity, with football and cricket a poor second (25%).

Social and daily living

18. Relations between families and single personnel?

Twenty-seven (37%) said the relations between families and single personnel were average. The mean was 2.86 with a standard deviation of 0.98, indicating a slightly unfavorable response.

19. Do you spend more time in your house than you did in other places (Coding is reversed)?

Twenty-four (33%) indicated they spent the most time in the house than they did in any other place in which they had lived recently. The mean was 2.52 with a standard deviation of 1.37.

20. Noise from neighbors? (Coding reversed)

Twenty-six (36%) said the noise from neighbors was less than most places where they had lived recently. The mean, however, was 2.94 with a standard deviation of 1.22, indicating a closer to "average" response on the whole.

21. Do you interact with people more than you did in other places you have lived?

Twenty-three (32%) say they interact with people at Shay Gap more than most places in which they had lived recently. The mean is 3.38 with a standard deviation of 1.20, indicating a closer to "average" response.

22. Do you experience a greater loss of energy in Shay Gap (reversed coding)?

Twenty-seven (37%) said they experience no more than average loss of energy compared to other places lived in recently. The mean was 2.63 and the standard deviation was 1.02. Twenty-five (34%) said they felt more of a loss of energy than most places lived in recently.

23. Did you get to know more people?

Thirty-one (42%) claim they got to know more people at Shay Gap than at any other place lived in recently. The mean was 3.98 with a standard deviation of 1.16.

24. Did you walk more? (Coding is reversed)

Thirty-one (42%) claim they walk more at Shay Gap than at any other place lived in recently. The mean is 2.75 with a standard deviation of 1.24.

25. How do you rate the quality of living in Shay Gap?

The respondents are somewhat divided between those who feel living at Shay Gap is average (33%) and those who felt it is the best of any place (30%). The mean is 3.59 with a standard deviation of 1.13, indicating a somewhat favorable trend.

26. Do you feel your children are safe?

Thirty-one (42%) felt children at Shay Gap are the safest of any place lived in recently. The mean is 4.15 and the standard deviation 0.92, indicating a strong positive response.

27. Are children endangered by the climate (coding reversed)?

Thirty-two (44%) feel children are no more or less endangered by the climate than at other places they had lived recently. The mean is 3.17 and the standard deviation is 0.96.

28. Do the children have more playmates?

Twenty-four (33%) felt children had more playmates than in most places in which they had lived recently. The mean was 3.67 and the standard deviation 1.05.

29. Do the children have more places to play?

Twenty-seven (37%) felt children had more places to play at Shay Gap than in most other places they had lived recently. The mean was 3.48 and the standard deviation 1.14.

#### The house

30. Do you feel the houses in Shay Gap are the best looking of any place you have lived?

Twenty-nine (40%) felt the houses in Shay Gap were comparable to other places in which they had lived recently. The mean, however, was 3.49 with a standard deviation of 0.99, indicating a slightly favorable trend.

31. Do you feel the courtyard is private?

Seventeen (23%) had no courtyards. These were largely single residents. Of those with courtyards, (56), seventeen (30%) felt the courtyards were more private than those in most places, but enough disagreed to make a mean of 2.98 with a standard deviation of 1.33, making a bipolar distribution on the issue between those who liked the courtyards (43%) versus those who did not (39%).

32. Do you use courtyards?

Twenty-two (30%) indicated that they do not use the courtyards at Shay Gap as much as they had used courtyards in other places they had lived. The mean response was 2.77 and the standard deviation was 1.27.

33. Do the houses seem like suburbia?

Twenty-two (30%) feel the houses are less like suburbia than those in most places they had lived recently. The mean was 2.90 and the standard deviation 1.30, indicating a nearly "average" response.

34. Are the interiors of the houses bland (coding order reversed)?

Twenty-five (34%) felt the interiors of the houses of Shay Gap were less bland than those in most places they had lived recently. The mean was 3.25 and the standard deviation 1.16.

35. Is the interior of the houses easily decorated?

Thirty-six (49%) felt the Shay Gap houses were more easily decorated than houses in most places they had lived recently. The mean was 3.77 and the standard deviation was 1.84.

36. Do the windows provide privacy?

Twenty-seven (37%) felt the windows of houses at Shay Gap provided more privacy than most places lived in recently. The mean was 3.11 and the standard deviation 1.18, indicating a nearly "average" response.

37. Is the plumbing noisy (coding reversed)?

Fifty-four (74%) indicated the plumbing at Shay Gap was the noisiest of any place they had lived in recently. The mean was 4.38 with a standard deviation of 1.10.

Table 2. Ranking of areas in terms of privacy.

(The table shows the number of people assigned the most common rank to a given area.)

<u>Rank</u>		<u>Area</u>	<u>No.</u>	<u>%</u>
1	Most private:	Inside house	48	66%
2		Living court	44	60%
3		Service court	27	37%
4		Paths and streets	39	53%
5	Least private:	Play and common areas	41	56%
6		Public buildings	41	56%

CONCLUSIONS FROM DESIGN QUESTIONNAIRE

Design hypotheses about site

Howroyd spend a great deal of time selecting the site for Shay Gap. He claims to have considered more than 16 locations before selecting this particular site with its protective hills (see

Fig. 1). The hills functioned like the walls of a medieval Middle Eastern village. The results intimate that most people like the hills, preferring them to a visible horizon.

Although residents liked the hills, they do not feel the hills provided significant protection from wind and dust nor provide significant amounts of shade. The psychological effect of the hills seems to have had the most greatest effect on residents. A resident commented, "I think the hills are beautiful, and I love to look at them." Many residents spoke about climbing on the hills during weekends. From our observations, the hills clearly served a recreational purpose.

Residents feel the townsite is small, but they feel less isolated than in most places they have lived in recently. The knowledge that Shay Gap will be moved apparently explains the feeling that it is less permanent than most places.

#### Community design hypotheses

Our tests confirm that residents perceive the houses to be very close together. Howroyd deliberately clustered the houses together so that they would shade one another, but attempted to disguise the closeness by manipulating the positions of the windows and of the houses themselves. He did not succeed in increasing perceived shade, but did succeed in minimizing noise and providing privacy.

Residents are dissatisfied with the selection of groceries and store goods, but at the same time they do not have to go outside the town to buy goods as often as they would have to in other places. This seemed to indicate a general dissatisfaction with goods in all mining towns, yet a reluctance to travel outside the town for better selection.

It is clear from the resident replies that the shopping center is the most used building with the club a close second. Residents feel there is a lack of outdoor space for gardens, pets, and storage.

Residents considered drinking at the club the most popular recreational activity, an observation we confirmed. Residents would spend hours sitting at the tables of the club drinking.

#### Social and daily living

Despite attempts to integrate single men and families, there is a kind of de facto segregation, reflected in the residents' answers to the question about relations between single men and families. Parents generally do not allow children near single quarters, and most single people said they felt uncomfortable if they had to walk in family quarters unless visiting a friend. Others felt visits with families were a little awkward. Some residents claimed that the main reason for a lack of integration was that there were too many single men at Shay Gap.



Residents did feel they spent more time in the house at Shay Gap, and that this did not mean they interacted with people a great deal more, yet they claimed to have met more people at Shay Gap.

Apparently, the design effort to get people out of their houses, to walk more, and to interact with one another more seems to have been a qualified success. It may not be entirely because of housing design since the management of social affairs can account for some of the increased social interaction.

Children are safe at Shay Gap, at least in the perception of the adults. It does not appear that the anxiety about automobiles was replaced by anxiety about the climate. Most people felt the climate was no worse than at other places.

Although not strong feelings, there was some tendency to feel children had more places to play and more playmates.

#### The house

Figure 3 shows typical houses at Shay Gap. Among the questions on the house, most residents agreed about the noisy plumbing. 74% felt it was the noisiest they had ever experienced. Most residents agreed the interiors were not bland, and there was some tendency to feel they were also easy to decorate.

Residents were divided about the privacy and use of the courtyards.

Residents ranked private areas as a fairly clear continuum from the most private, which was the 'inside of the house, to the least private, which were the play and common areas and the public buildings. This result confirms the design hypotheses about territoriality.

#### Outstanding physical features

The windows, the plumbing, and the air conditioning are three physical features that stood out in the evaluation of Shay Gap. Because of the central air conditioning system, it was decided to make the windows inoperable, a generally accepted practice with central air conditioning systems. Several residents complained that the windows should be operable, yet most recognized the necessity for controlling the windows.

Company officials stated that of all the design features of Shay Gap, the air conditioning and the plumbing were the two that they would like to duplicate in future communities.

#### General conclusions

The selection of a site enclosed by hills, the safety of the children, and the increased socialization seem to be the successful parts of the Shay Gap design, judging from the design questionnaire.



Figure 3. Houses of Shay Gap.

Failure to integrate single men and families stands out as the largest failure, though this may have causes not related to design. The perception that there was inadequate outdoor space for storage, pets, and gardens was confirmed.

#### BEHAVIOR SETTING SURVEY

##### General

At the time of the study, (April 1977), the population of Shay Gap was given as 885. This included 420 employees, 137 other adults (wives), 236 children, and 92 contracted employees. 148 were married employees, 272 were single employees. Of the children, 134 were preschool, 91 were in primary school, and 10 attended boarding high schools in other parts of the country.

The behavior setting survey measured 241 behavior settings and 137 genotypes. Since a small portion of the population was sampled, this number can be extrapolated to 2,113 behavior settings. This number gives a ratio of settings to population of 2.45, which compares favorably with Barker's (1968) small town where the ratio was about 1.1. However, the ratio of genotypes for Shay Gap is less favorable, 0.16 to 0.26. This indicates that Shay Gap has more settings available per person, but it has fewer varieties of settings available.

A list of genotypes is contained in Appendix A.

##### Schematic plan

Shay Gap has a general plan quite similar to that of Nanisivik, North West Territory, Canada. (See Bechtel and Ledbetter 1980, p. 3). The housing area and single men's quarters border on the central facility, while the work site is remote (see Fig. 4).

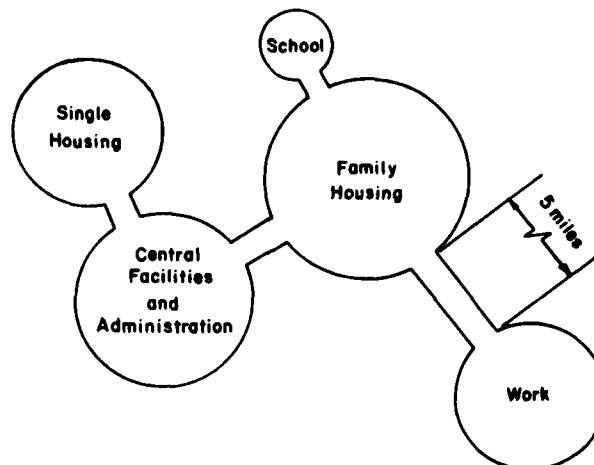


Figure 4. Schematic plan of Shay Gap.

### Action patterns

Figure 5 shows the profile of action patterns at Shay Gap. The most prominent action pattern was social contact. Social contact was present at all measured behavior settings. It was a prominent pattern (more than 50% of occupancy time) in 65% of the public settings.

Figure 6 shows the action pattern profile for the 40 families surveyed. The social contact and recreation action patterns are more prominent than usual. In the rest of the profile, scores measuring presence are higher than usual, but scores measuring prominence are lower. The implication is that recreation and social contact are more prominent than usual with the other kinds of behavior reduced from normal prominence to mere presence.

### Behavior mechanisms

The behavior mechanisms of the 160 public settings are shown in Figure 7. All five mechanisms are present in a majority of settings, with talking prominent in 28%.

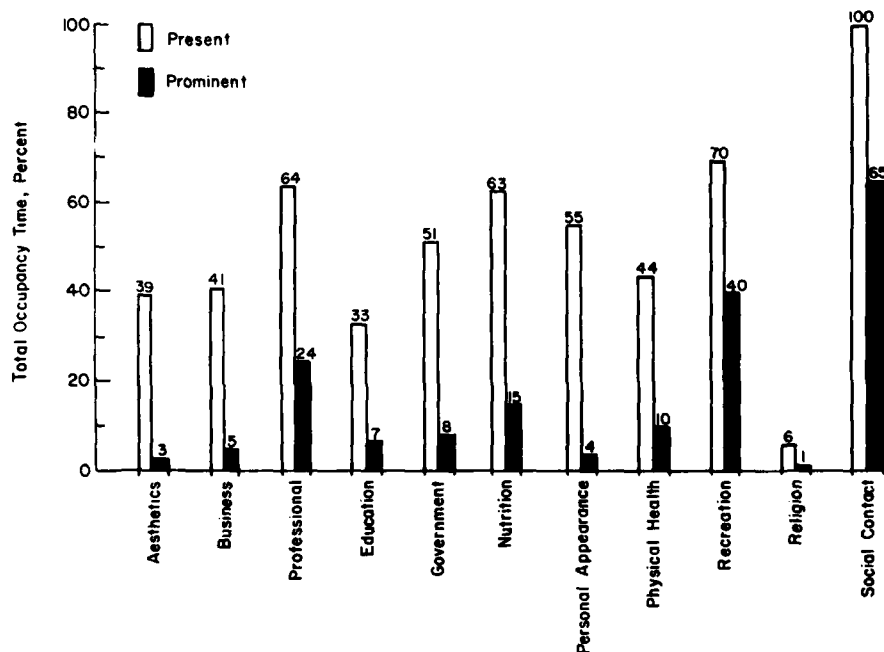


Figure 5. Action pattern scores as percent of occupancy time for 160 public settings.

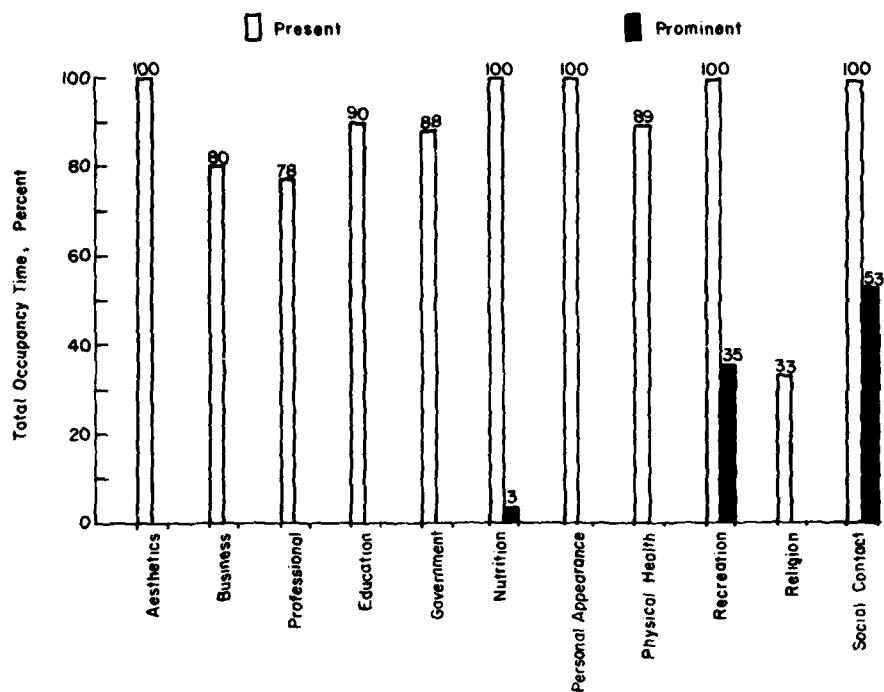


Figure 6. Action patterns as a percent of occupancy time for 40 family settings

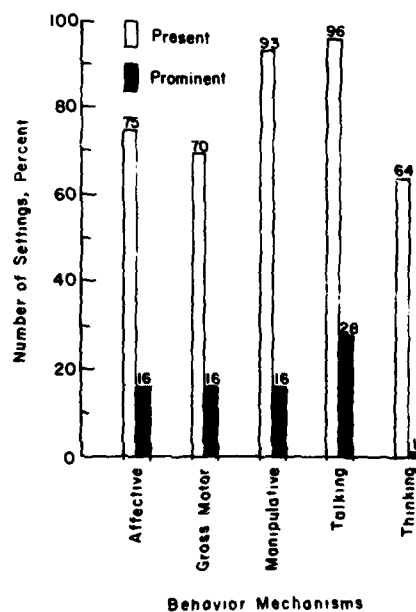


Figure 7. Behavior mechanisms as a percent of occupancy for 160 public settings.

### Autonomy ratings

Autonomy ratings for the 162 public settings measured indicate a very high level of autonomy for Shay Gap (Fig. 8). 79% of the public settings have a nine rating, indicating that decisions on performers, programs, finances, and admittance to settings are made at the local level. These ratings are probably due to the high level of local autonomy granted by the company and the presence of a town manager and local policeman to make decisions at the community level.

No other community studied had such a high level of autonomy. Nanisivik, the Canadian mining town, came closest with 56% of its public settings at the nine level. However, the small town Barker (1968) studied had only 25% of its public settings at the nine level. Fort Wainwright in Alaska had 20% at the nine level. Other communities averaged less than 5% at the nine level.

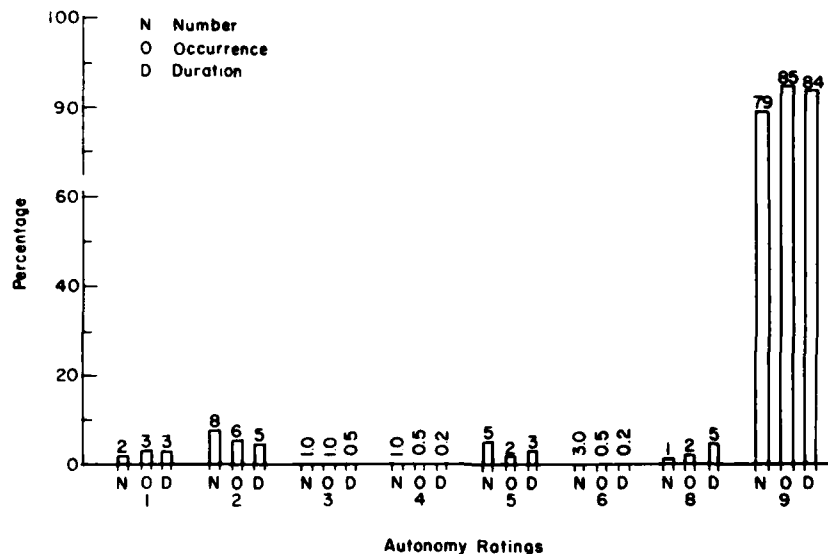


Figure 8. Autonomy ratings for 160 public behavior settings.

### Welfare and pressure ratings

Pressure ratings indicate that children are discouraged or prohibited from entering a large number of settings in Shay Gap (43%). The mean pressure rating for the public settings is 4.97 which is on the tolerated side of neutral. Yet, observation showed that children were more evident than in any other community previously studied. The mean for adolescents was 4.99. Figure 9 shows the pressure ratings for the public settings.

Welfare ratings show the majority of public settings are neutral to the welfare of children (89%) and adolescents (94%). Figure 10 shows welfare ratings.

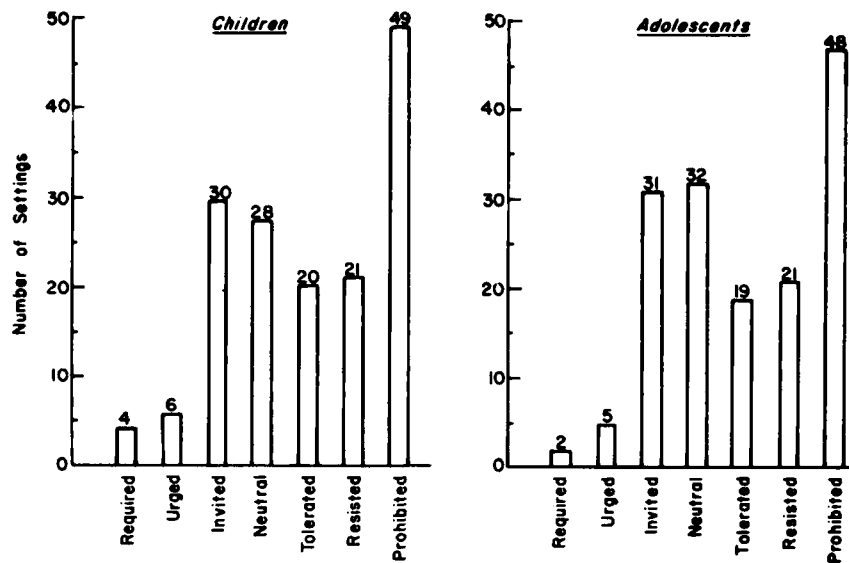


Figure 9. Pressure ratings for children and adolescents for 160 public settings.

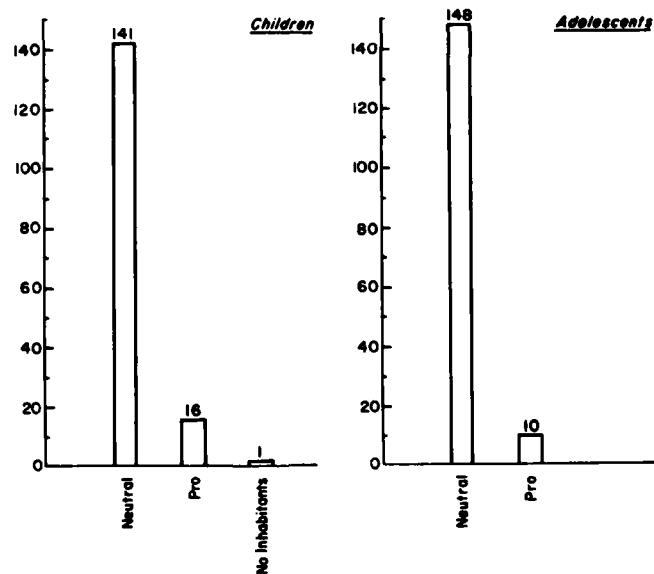


Figure 10. Welfare ratings for children and adolescents for 160 public behavior settings.

### General richness index

The mean GRI rating for public settings was 11.54 with a large standard deviation of 11.40. This rating is slightly lower than that of a large Alaskan military base (12.06) (see Bechtel and Ledbetter 1976), or of the Canadian mining community of Nanisivik (13.27). However, it is higher than the GRI for a Negro public housing project in Ohio (8.54) and a poor white residential block in Kansas City, Mo. (7.88).

The GRI for the 40 Shay Gap families was 21.2 which is higher than that of the families at Nanisivik (18.07). Families, because they have relatively large numbers of children and of individuals living in close quarters, generally have higher GRI scores than the community at large.

Single men show a GRI of 9.5 which is below the level of public settings, but a typical rating for single men, halfway between the GRI of single men at Nanisivik (6.00) and that of soldiers in the barracks of a large military base in Alaska (12.3).

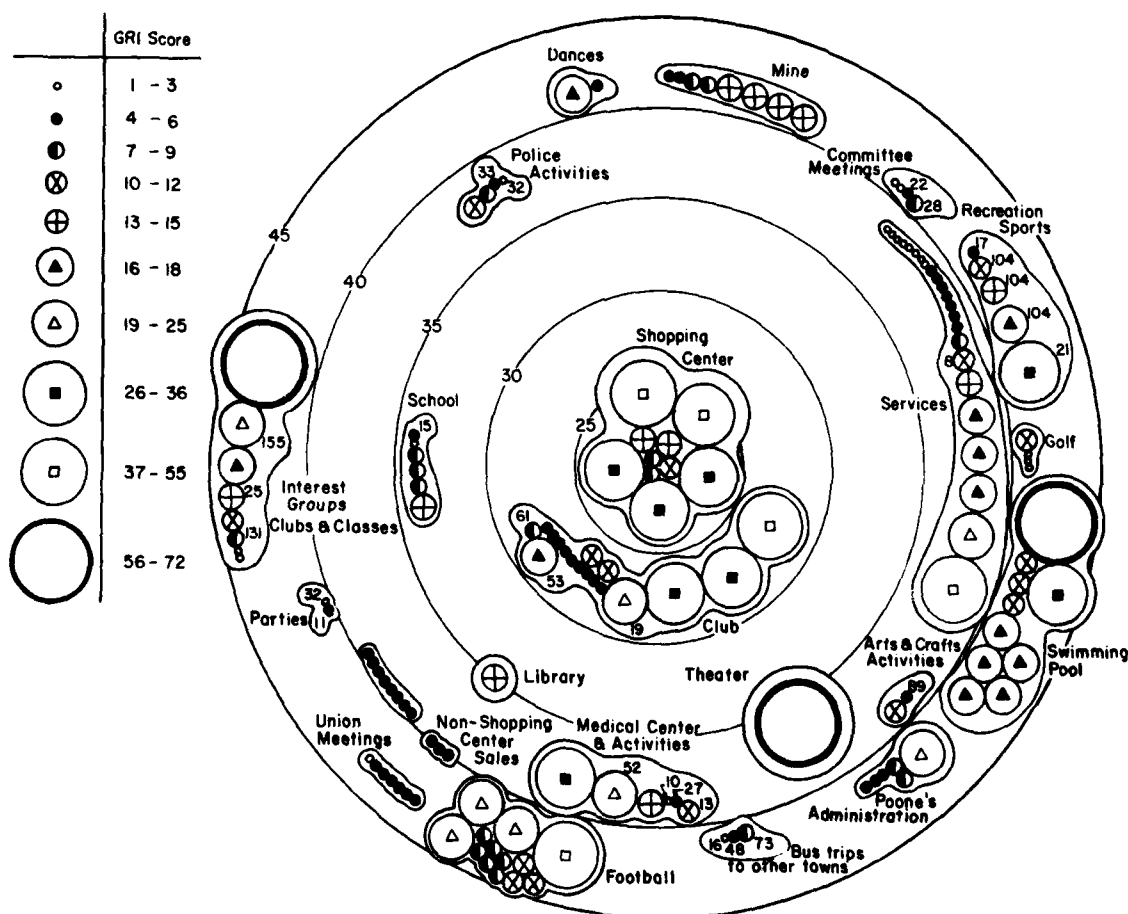


Figure 11. Public behavior settings in relation to the behavioral focal point.



### General richness index by building and location

Table 3 provides a list of buildings and locations at Shay Gap with the number of behavior settings and the average GRI for each location.

From this table it is clear that the richest location is the outdoor theatre (GRI = 72). The next richest setting was the dining room (GRI = 50) followed by the shopping complex (GRI = 21.7), followed by the club (GRI = 14). The theatre is the richest setting because the entire population of Shay Gap gathers there to engage in a large range of activity. Adults and children at the theatre eat, drink, socialize and play as well as sit and watch movies. The movies are the largest and most widely attended social event in the daily life of Shay Gap.

Table 3. General richness index by building and location.

<u>Location</u>	<u>No. behavior settings</u>	<u>Average GRI</u>
Administration building and medical center	22	10.18
Dining room	1	50.
Club	21	14.09
Shopping complex	12	21.67
School library	2	8.
Arts and crafts center	2	8.
Air conditioning maintenance operation	1	10.
Mine	6	8.5
On and off site	21	8.62
Off site roads	1	6.
On site roads	3	4.67
Theatre	1	72.
Police station	2	8.5
Off site activities	6	10.17
School	3	10.
Throughout site	17	17.
Various houses	35	5.68
Contractor	3	16.

### Behavioral focal point

Figure 11 shows the 160 public behavior settings of Shay Gap as they relate to the behavioral focal point. The behavioral focal point of a community is the place where every member of the community can come into contact with every other member. Without this kind of place, the members of a community could not get to know one another. It must be a place where frequent contact can take place. While the outdoor theatre of Shay Gap is certainly one of the focal points of the community, it does not serve as well as the shopping complex because contact at the theatre only occurs about 156 days (Wednesday, Friday, and Sunday) a year, for about two hours each time. The shopping center is open 365

days a year even though various businesses will be open only about 300 days. The shopping center is also open for the full business day and into most evenings. We observed a constant range of activity from morning until noon break, and then into the evening.

The shopping center serves as the chief behavioral focal point of Shay Gap with the theatre, the dining room, and the club as secondary focal points. The activity of these places contributes to the fact that Shay Gap, in the perception of most residents, was a place where they got to know more people than any other place in which they had lived. Residents felt they used the shopping center most frequently, an observation supported by the shopping center's 48,080 hours of occupancy time (opposed to 25,956 for the club). The theatre, however, had 258,599 hours of occupancy time (more than five as much as the shopping center).

#### Measures of isolation

Behavior settings that begin inside a community but go outside are called extrusive settings. Behavior settings that begin outside and come into the community are called intrusive settings. The ratio of intrusive and extrusive settings to the on-site settings is a measure of isolation.

Table 4 shows ratios of extrusive and intrusive settings for various communities compared to Shay Gap.

Table 4. Intrusive and extrusive setting percentages for various communities.

<u>Community</u>	<u>% Extrusive</u>	<u>% On site</u>	<u>% Intrusive</u>
Fort Wainwright, Alaska	2	96	2.
FAA settlements, Alaska	7	79	14.
Aircraft control and warning stations, Alaska	3	86	11.
Nanisivik, Canada	8	85	7.
Shay Gap	8.7	82	8.7

Shay Gap is most comparable to Nanisivik, the Canadian mining town. Both of these communities are not quite as isolated as the larger military base in Alaska, but seem to rank close to the FAA and AC&W stations. It should be noted from the questionnaire results that 52% of the residents felt Shay Gap was the least isolated of any community in which they had recently lived.

#### Performance-population ratios

Performance-population ratios are calculated by dividing the number of performers in a setting by the total number of inhabitants in the setting. The highest possible ratio is 1.00, where everyone would be a performer. In essence, this ratio is a measure of the amount of leadership in a community. Comparable ratios are given below (Table 5).

Table 5. Performance-population ratios of isolated communities

AC&W stations, Alaska	0.65
FAA stations, Alaska	0.45
Fort Wainwright, Alaska	0.31
Nanisivik, N.W.T.	0.30
Shay Gap, Australia	0.48

Shay Gap has a relatively high ratio of leaders in the 160 public settings measured. In fact, the only community with a higher ratio are the AC&W stations, which are deliberately undermanned by U.S. Air Force policy.

Barker (1965) and Bechtel (1977) established that communities which have settings with high performer-population ratios have more satisfied inhabitants. This is largely because the more people with positions of responsibility, the more contented they seem to be, other things being equal. These results may only pertain to the family residents of Shay Gap since they make up a large majority of the population in public settings.

#### Occupancy times of residences

In the 39 families interviewed, the male head of the household spent an average of 2,597.5 waking hours a year in the house. This average is far less than the time in the house for male heads of households in a large Alaskan military base (4,580), but more than the time spent in the house by male heads of households at Nanisivik (1,647).

Wives at Shay Gap showed an average occupancy time in the house of 4,476, which is more than at Nanisivik (2,169) but less than the Alaskan military base (6,380). The low occupancy time at Nanisivik was because all the women worked. The higher occupancy in Alaska is because only one third of the wives worked and because there is a tendency to stay indoors a great deal.

Single men and women (N=6) reported an average occupancy time of 1,948 hours, which compares roughly with Nanisivik's 1,647 hours.

The number of visitor hours for Shay Gap for families was 192. This compares with Nanisivik's 221, but is much lower than the Alaskan base's 696.

On most points Nanisivik and Shay Gap are comparable. This might be expected since both are mining communities. The differences between Nanisivik and Shay Gap are largely due to the greater number of hours worked at Nanisivik and the fact that all women surveyed in Nanisivik were working. These data show that hours worked have a major effect on the time spent in the home. There might be a suggestion, since both Shay Gap and Nanisivik report greater contentment than the Alaskan military base, that longer working hours at the military base would be beneficial.

TABLE 6. Confirmation of favorable design decisions  
testing 55 design hypotheses\*

<u>Data not sufficient</u> <u>no. of hypothesis</u>	<u>Trend in favor</u> <u>no. of hypothesis</u>	<u>Trend against</u> <u>no. of hypothesis</u>
1	4	10
2	5	12
3	6	16
7	8	20
11	9	24
13	18	27
14	19	29
15	21	37
17	22	39
28	23	44
32	25	46
35	26	47
41	30	53
43	31	54
49	33	55a
	34	
	36	
	38	
	40	
	42	
	45	
	48	
	50	
	51	
	52	
	55b	

\* 55 was divided into 55a (outdoor) and  
55b (indoor) making  
56 total

## CONCLUSIONS

Shay Gap provided in many ways an ideal setting for a post occupancy evaluation. The architect made clear decisions based on logical assumptions, and the design factors were different enough from those of a average community that behavioral changes could be attributed to them. In the architect's words, "A living laboratory -that's what Shay Gap was."

Lawrence Howroyd researched the problems of the hot, arid climate of Shay Gap and came up with a basic concept for community design: the community would be walled or enclosed with closely spaced houses and automobiles only along the outside perimeter.

Secondary design decisions followed from these basic principles. The enclosed community and crowded houses defined the site as a small one (see Fig. 6 and Appendix D).

While not all of the hypotheses proved correct, the basic design principles seem to be fairly well substantiated. The wall of hills was highly favored. Residents perceived the closeness of the houses, but it did not affect their privacy. Residents did, however, perceive the site as being small and lacking certain kinds of outdoor storage space.

The elimination of the automobile increased the perceived safety of the children. The combination of pathways, lack of automobiles, and behavioral focal points certainly contributed to the greater perceived sociability on the part of residents.

The design principles incorporated in Shay Gap are valid for cold region communities and isolated communities in general. The concept of the "walled" community is particularly important. Of course, since this site had natural hills, we cannot assert that the residents would have accepted the "walls" to the same degree had they been artificial. Nevertheless, the residents' overwhelming support of the enclosed community demonstrates that it is an acceptable design.

A "wall" can be used in both deserts and cold regions, since towns in both regions need protection from wind and dust (or snow). Even though the residents did not feel they were more protected from dust and wind than they had been at other locations, they felt they were at least as protected as they had been at the other locations.

Testing the effects of restricting automobiles was critical. The fact that residents perceived that restricting automobiles did increase the safety of their children should be borne in mind when future remote communities are designed. It is possible that in colder climates residents would view the distance they have to walk negatively because of adverse climate. Yet Shay Gap residents did not feel overly exposed to the sun, snakes, and insects of the area.

The bland interiors were highly praised, a fact that would give pause to many designers. This finding has been confirmed in Iran, Saudi Arabia (Bechtel 1975, 1976), and the U.S. (Bechtel and Ledbetter 1976). The more personal choice allowed in interior housing design, the more residents like the housing. Shay Gap results show that the design should allow the user to express his own taste instead of expressing the taste of the designer.

Finally, the results of the Shay Gap evaluation show that the shopping center fared much better than the architect imagined. Howroyd apologized for the shopping center, feeling he had been wrong to put that many facilities under one roof. The results show the shopping center functioned well as a behavioral focal point. Chances are the shopping center would not have been as successful if the various services it contains had been dispersed among separate buildings (c.f. Bechtel and Ledbetter 1980). In fact, the data from Shay Gap show that there might have been a better behavioral focal point if the club and the shopping center had faced a common, crowded mall.

In any case, an enclosed mall should be incorporated in both cold and hot region communities since it will contribute greatly in terms of sociability and convenience.

One clear failure was the result of forces beyond Howroyd's control. It was his original intention that the school would be the focal point of community activity, a center that could serve as a meeting place for adults after hours. Before his plan was finalized, the personnel at Goldsworthy Mining changed and the continuity of planning was lost. As a result, the school was placed on the community periphery.

There is reasonable doubt that the school could have ever functioned as a successful focal point. From what is known about focal points (c.f. Bechtel 1977), the school does not have a wide enough variety of attractions to compete with the shopping center or the club.

The school did serve one important function, however, besides the usual educational chores. It provided the principal source of childhood friendships. Forty-three children were stopped at random in their play at various locations throughout the site. They were asked whether their playmates came from school, housing precincts, etc. Of the forty-three, twenty-seven replied the school, another five indicated the kindergarten. Thirty-two of the forty-three, or 74%, found their playmates from school associations rather than in the neighborhood.

One could expect this since the school or kindergarten is the place where children spend their largest block of time. For adults, the place of work functions in the same manner.

Shay Gap has a successful design that can serve as an example in the future for remote communities in both hot and cold climates.

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## APPENDIX A: SHAY GAP GENOTYPES

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Air conditioning maintenance operation</li> <li>2. Ambulance runs (21)</li> <li>3. AMW Union meetings</li> <li>4. AWC Union meetings</li> <li>5. Arts and crafts association (78)</li> <li>6. ASENDA Union meetings</li> <li>7. Baby weigh</li> <li>8. Badminton (104)</li> <li>9. Bank managing</li> <li>10. Barber</li> <li>11. Bible study group</li> <li>12. Boutique operations</li> <li>13. BTA Union meetings</li> <li>14. Bus trip to Pt. Hedland</li> <li>15. Catholic service (20)</li> <li>16. Circular and news boy</li> <li>17. Clay target shooting</li> <li>18. Cleaning (3)</li> <li>19. Club managing</li> <li>20. Community health doctor's visit to school (3)</li> <li>21. Cosmetic product selling</li> <li>22. County Women's Association &amp; activity preparation (27)</li> <li>23. Cricket (21)</li> <li>24. CWA dampier conference</li> <li>25. CWA progressive dinner</li> <li>26. Dances (14+15+1)</li> <li>27. Dart games (110+5+62)</li> <li>28. Dentist visit (2)</li> <li>29. Dog catcher activities</li> <li>30. Drinking (2)</li> <li>31. Electrical general services</li> <li>32. Electrical shop</li> </ol> | <ol style="list-style-type: none"> <li>33. Environmental officer</li> <li>34. ETU Union meetings</li> <li>35. Euchre games (52)</li> <li>36. Family housing (108)</li> <li>37. Fashion parade (2)</li> <li>38. FED Union meetings</li> <li>39. First aid classes (12)</li> <li>40. Flying doctor medical emergency radio room (10)</li> <li>41. Football games (12)</li> <li>42. Football little league (3)</li> <li>43. Football membership committee</li> <li>44. Football practice</li> <li>45. Football presentation night and preparation</li> <li>46. Friday night working women's get together (52)</li> <li>47. Gardening - handyman work</li> <li>48. Girl Scout meetings (50)</li> <li>49. General carpentry work</li> <li>50. General medical clinic duties</li> <li>51. General practitioner doctor visits (52)</li> <li>52. General services foreman</li> <li>53. Golf club</li> <li>54. Golf matches at Goldsworthy (3)</li> <li>55. Grama Droup (drama group) (155)</li> <li>56. Grocery store</li> <li>57. Indian clothes selling</li> <li>58. Indian lace setting</li> <li>59. International rule basketball (104)</li> <li>60. Justice of Peace cases (28)</li> <li>61. Kiosk (P &amp; C)</li> <li>62. Kids' day at the mine (4)</li> <li>63. Kindergarten committee (15)</li> <li>64. Labor Party activities (4)</li> <li>65. Ladies' basketball (52)</li> </ol> |
|--|---|



66. Lapidary club
67. Lawn bowling (52)
68. Leather craft classes (10)
69. Liberal Party activities
70. Library
71. Lighting landing strip (7)
72. Lingerie party
73. Magistrate's visit (7)
74. Mail pickup between mine and Shay Gap
75. Meat market
76. Medical health sister immunization clinic
77. Medical office visits for non-doctor treatment
78. Mess committee
79. Mine accident - fatal
80. MMA Transport Co.
81. Music lessons (104)
82. P & C barbecue & raffle
83. P & C Association (15)
84. Petitioning for playground equipment
85. Playgroup for children
86. Police criminal charges (8)
87. Police road patrol
88. Police station
89. Police traffic charges (32)
90. Poon's Administration Office
91. Poon's audit (2)
92. Poon's booking-in single men
93. Poon's BP Service Station
94. Poon's catered parties (6)
95. Poon's dry goods truck delivery
96. Poon's executive visits
97. Poon's freezer truck delivery
98. Poon's garbage
99. Poon's mail run
100. Poon's town inspection
101. Poon's warehouse
102. Poon's wet canteen
103. Post Office
104. Pottery club
105. Retail store managing
106. Road repairs and airstrip maintenance
107. Safety Committee meetings
108. Secretaries (3)
109. Sewage maintenance operation
110. Shindig - CNA (30)
111. Shopping center halls and sidewalks
112. Single men - housing (356)
113. Silver jubilee bonfire (Girl Guides) (8)
114. Snack bars (26)
115. Soft toy parties
116. Stewards committee
117. Swimathon (5)
118. Swimming meet (3)
119. Swimming pool operation
120. Swimming trip (Tom Price)
121. Television watching at club
122. Theater
123. Tony Charlton entertainment evening (4)
124. Township Committee meeting
125. Trips to eye doctor at Pt. Hedland (48)
126. Trips to gynecologist at Goldsworthy (72)
127. Trips to psychiatrist at Pt. Hedland (16)
128. Truck over dump-death (2)
129. Tupperware parties (4)
130. TWU Union meetings
131. United Development Corp. (3)
132. Vet visit (4)
133. Volunteer fire brigade
134. Water supply
135. Weight Watchers club
136. Yoga classes
137. Youth club

# APPENDIX B: DESIGN QUESTIONNAIRE FOR SHAY GAP

2. Compared to the average in other places you've recently lived, the wind in SHAY GAP is:

Least in Volume and Annoyance	5
Less than Most	4
The Same	3
More than Most	2
The Most of any place	1

3. Compared to the average in other places you've recently lived in, the dust at SHAY GAP is:

The Least in Volume and Annoyance	5
Less than Most	4
The Same	3
More than Most	2
The Most of any place	1

4. Compared to the average in other places you've lived in recently, the whole town of SHAY GAP has:

More Space than any other	5
More Space than Most	4
Same	3
Less Space than Most	2
The Least Space of any other	1

Have you lived in other company towns? ☐ cities? ☐ rural? ☐

Probe: Where have you lived most of your adult life?

Name of towns: \_\_\_\_\_

cities: \_\_\_\_\_

What is your precinct color and number? Correct ☐ Wrong ☐

How would you rate SHAY GAP compared to those other places in which you recently lived?

A. Site

1. Compared to the average of other places you recently lived in, are the surrounding hills:

Comforting and Protective	5
Pleasant	4
No Different from towns without hills	3
Slightly Uncomfortable (Confining)	2
Confining and Limiting	1
Other	

Do you prefer hills or an open view?

5. Compared to the average in other places you've lived

in recently, the amount of shade in SHAY GAP is:

- |                      |   |
|----------------------|---|
| The Best of any      | 5 |
| Better than Most     | 4 |
| Same                 | 3 |
| Worse than Most      | 2 |
| The Worst of Many    | 1 |
| A. Due to Hills      |   |
| B. Due to Roof       |   |
| C. Due to Vegetation |   |

6. Compared to the average in the places you've lived in recently, SHAY GAP is:

- |                                      |   |
|--------------------------------------|---|
| The Most Isolated I've Lived in      | 1 |
| More Isolated than Most              | 2 |
| About the Average level of Isolation | 3 |
| Less Isolated than Most              | 4 |
| The Least Isolated I've Lived in     | 5 |

7. Compared to the average in the places you've lived in recently, SHAY GAP is:

- |                                  |   |
|----------------------------------|---|
| The Most Permanent I've Lived in | 5 |
| More Permanent than Most         | 4 |
| Average in Permanence            | 3 |
| Less Permanent than Most         | 2 |
| The Least Permanent of Any       | 1 |

B. Community

8. Compared to the average in places you've lived in recently, are the groceries and other store goods available in SHAY GAP?

- |                       |   |
|-----------------------|---|
| The Best of any place | 5 |
| Better than Most      | 4 |
| Average               | 3 |
| Worse than Most       | 2 |
| The Worst of many     | 1 |

9. Compared to the average in places you've lived in recently, the houses in SHAY GAP are:

- |                                   |   |
|-----------------------------------|---|
| The Closest Together of any place | 1 |
| Closer Together than Most         | 2 |
| Average                           | 3 |
| Not as Close as Most              | 4 |
| The Farthest Apart of any         | 5 |

10. Do you find you go outside of SHAY GAP to buy things?

- |                           |   |
|---------------------------|---|
| More than any other place | 1 |
| More than Most            | 2 |
| Average                   | 3 |
| Less than Most            | 4 |
| Least of any place        | 5 |

11. Compared to the average in places you've lived in recently,

the shopping center at SHAY GAP is:

- The Best of any place 5
- Better than Most 4
- Average 3
- Worse than Most 2
- The Worst of any 1

12. Compared to the average in places you've lived in recently,

the space for raising and exercising pets in SHAY GAP is:

- The Best of any place 5
- Better than Most 4
- Average 3
- Worse than Most 2
- The Worst of any 1

13. Compared to other areas you've lived in recently, the

storage areas in SHAY GAP are:

Outdoor

- The Best of any place 5
- Better than Most 4
- Average 3
- Worse than Most 2
- The Worst of any 1

Indoor

- The Best of any place 5
- Better than Most 4
- Average 3
- Worse than Most 2
- The Worst of any 1

C.

Social and Daily Living

18. Compared to other areas you've lived in recently, at SHAY

GAP the relations between family and single personnel are:

- The Best of any 5
- Better than Most 4
- Average 3
- Worse than Most 2
- Worst of any 1

14. Compared to other areas you've lived in recently, the

space for gardens in SHAY GAP is:

- The Best of any place 5
- Better than Most 4
- Average 3
- Worse than Most 2
- The worst of any 1

Where do you garden? \_\_\_\_\_

15. Compared to other areas you've lived in recently, the

number of clean areas in SHAY GAP IS:

- The Best of any place 5
- Better than Most 4
- Average 3
- Worse than Most 2
- The worst of any 1

16. What building is the place most used by everybody?

Probe: More people go there than any other

17. What is the most popular recreational activity in SHAY GAP?

19. Compared to other areas you've lived in recently, do you (or wife) spend:
- |   |   |
|---|---|
| More Time in the House than any other place | 1 |
| More Time than Most                         | 2 |
| The Same as other places                    | 3 |
| Less Time than Most other places            | 4 |
| The Least Time in the House of any place    | 5 |
20. Compared to other areas you've lived in recently, do you notice noise from your neighbors:
- |                           |   |
|---------------------------|---|
| More than any other place | 1 |
| More than Most places     | 2 |
| Average                   | 3 |
| Less than Most places     | 4 |
| The Least of any place    | 5 |
21. Compared to other areas you've lived in recently, do you feel that at SHAY GAP that you interact with people:
- |                           |   |
|---------------------------|---|
| More than any other place | 5 |
| More than Most places     | 4 |
| Average                   | 3 |
| Less than Most            | 2 |
| Least of any place        | 1 |
22. Compared to other areas you've lived in recently, do you experience a loss of energy (get tired) at SHAY GAP:
- Probe: Over the whole year
- |                           |   |
|---------------------------|---|
| More than any other place | 1 |
| More than Most            | 2 |
| Average                   | 3 |
| Less than Most            | 4 |
| Least of any place        | 5 |
23. Compared to other areas you've lived in recently, do you feel you got to know:
- |  |   |
|--|---|
| More People in Shay Gap than any other place | 5 |
| More than Most                               | 4 |
| Average                                      | 3 |
| Less than Most                               | 2 |
| Least of any                                 | 1 |
24. Compared to other areas you've lived in recently, do you feel you walk
- |                     |   |
|---------------------|---|
| More than any place | 5 |
| More than Most      | 4 |
| Average             | 3 |
| Less than Most      | 2 |
| Least of all        | 1 |

25. Compared to other areas you've lived in recently, do you think that living in SHAY GAP is:

The Best of any place	5
Better than Most	4
Average	3
Worse than Most	2
Worst of all	1

28. Compared to other areas you've lived in recently, do children at SHAY GAP have:

More Playmates than any other place	5
More than Most	4
Average	3
Fewer Playmates than Most	2
Fewer than any	1

#### D. Children

26. Compared to other areas you've lived in recently, are children in the streets and pathways of SHAY GAP:

The Safest of any place	5
Safer than most	4
Average	3
Not as Safe as Most	2
The Least Safe of any	1

29. Compared to other places you've lived in recently, do children in SHAY GAP have (outside):

More places to Play than any other	5
More than Most	4
Average	3
Worse than Most	2
Worst of any place	1

#### E. The House

27. Compared to other areas you've lived in recently, are children endangered by the climate at SHAY GAP:

Worse than any place	1
Worse than Most	2
Average	3
Less than Most	4
Least of any place	5

30. Compared to other areas you've lived in recently, are the houses at SHAY GAP:

Better Looking of any place	5
Better Looking than Most	4
Average	3
Worse than Most	2
Worst of any place	1

31. Compared to other areas you've lived in recently, are the courtyards at SHAY GAP:
- |                               |   |
|-------------------------------|---|
| The Most Private of any place | 5 |
| More Private than Most        | 4 |
| Average                       | 3 |
| Less Private than Most        | 2 |
| Least Private of any place    | 1 |
32. Compared to other areas you've lived in recently, do you use the courtyards at SHAY GAP:
- |                     |   |
|---------------------|---|
| More than any place | 5 |
| More than Most      | 4 |
| Average             | 3 |
| Less than Most      | 2 |
| The Least of any    | 1 |
33. Compared to other areas you've lived in recently, do the houses at SHAY GAP seem like a suburban single family house:
- |                     |   |
|---------------------|---|
| More than any place | 5 |
| More than Most      | 4 |
| Average             | 3 |
| Less than Most      | 2 |
| Least of any place  | 1 |
34. Compared to other areas you've lived in recently, does the inside of the houses at SHAY GAP seem:
- |   |   |
|---|---|
| Most bland (uninteresting) of any place | 1 |
| More Bland than Most                    | 2 |
| Average                                 | 3 |
| Less Bland than Most                    | 4 |
| Least Bland of any                      | 5 |
35. Compared to other areas you've lived in recently, is the inside of the houses:
- |                       |   |
|-----------------------|---|
| Most easily Decorated | 5 |
| More easily           | 4 |
| Average               | 3 |
| Less easily than Most | 2 |
| Least easy of any     | 1 |
36. Compared to other areas you've lived in recently, the windows in the houses (rooms) at SHAY GAP:
- |                                       |   |
|---------------------------------------|---|
| Provide the Most Privacy of any place | 5 |
| More Privacy than Most                | 4 |
| Average                               | 3 |
| Less Privacy than Most                | 2 |
| Least Private of any place            | 1 |

37. Compared to other areas you've lived in recently, the plumbing in the houses (rooms) at SHAY GAP is:

- |                       |   |
|-----------------------|---|
| Noisiest of any place | 1 |
| Noisier than Most     | 2 |
| Average               | 3 |
| Less Noisy than Most  | 4 |
| Least Noisy of any    | 5 |

38. Consider the areas you move around and live in at SHAY GAP and please rank them in terms of the most private to the least private:

- Inside the House
- Living Court (Barbeque, etc.)
- Service Court (Laundry)
- Paths and Streets
- Play areas, Common areas
- Public Buildings (Shopping Center, Club, etc.)



# APPENDIX C: CHI SQUARE TESTS FOR STATISTICAL SIGNIFICANCE OF DESIGN QUESTIONNAIRE RESPONSES

Question 2. Wind:	Distribution	Chi Square Data
	5. 9	Chi square = 23.65
	4. 27	d.f. = 4
	3. 22	P < .001
	2. 9	
	1. 6	
Question 3. Dust:	5. 21	Chi square = 18.70
	4. 23	d.f. = 4
	3. 17	P < .001
	2. 4	
	1. 8	
Question 4. Space:	5. 7	Chi square = 20.08
	4. 12	d.f. = 4
	3. 10	P < .001
	2. 29	
	1. 15	
Question 5. Shade:	5. 5	Chi square = 31.85
	4. 29	d.f. = 4
	3. 20	P < .001
	2. 16	
	1. 3	
Question 6. Isolation:	5. 3	Chi square = 52.69
	4. 11	d.f. = 4
	3. 15	P < .001
	2. 6	
	1. 38	

The chi square one sample test measures whether an answer distribution differs significantly from chance replies. In the case of the Shay Gap sample of 73 respondents, this would mean that if answers were made at random among the five possible choices, 14.6 would answer in each category. Each chi square test is a measure against this expected frequency.

Refer to Appendix B for a complete wording of each item.

Question 1. Hills:	Distribution	Chi Square Data
	5. 34	Chi square = 27.9
	4. 19	d.f. = 2
	3. 18	P < .001
	2. 1	(last two categories collapsed because of low frequencies)
	1. 1	
	Hills 46	Chi square = 35.28
	Horizon 3	d.f. = 1
		P < .001

Question 7. <u>Permanency:</u>	<u>Distribution</u> 5. 12 4. 7 3. 10 2. 10 1. 34	<u>Chi Square Data</u> Chi square = 33.10 d.f. = 4 P < .001	Question 12. <u>Pets:</u>	<u>Distribution</u> 5. 1 4. 13 3. 19 2. 28 1. 12	<u>Chi Square Data</u> Chi square = 44.96 d.f. = 4 P < .001
Question 8. <u>Groceries:</u>	5. 1 4. 10 3. 21 2. 21 1. 20	Chi square = 21.73 d.f. = 4 P < .001	Question 13. <u>Outdoor Storage:</u>	5. 3 4. 7 3. 13 2. 30 1. 6	N = 59 Chi square = 39.55 d.f. = 4 P < .001
Question 9. <u>Houses Close:</u>	1. 44 2. 11 3. 8 4. 9 5. 1	Chi square = 77.84 d.f. = 4 P < .001	<u>Indoor Storage:</u>	5. 16 4. 26 3. 17 2. 6 1. 8	Chi square = 17.47 d.f. = 4 P < .01
Question 10. <u>Outside To Buy:</u>	1. 9 2. 8 3. 22 4. 18 5. 16	Chi square = 9.80 d.f. = 4 P < .05	Question 14. <u>Gardens:</u>	5. 2 4. 20 3. 20 2. 18 1. 13	Chi square = 15.82 d.f. = 4 P < .01
Question 11. <u>Shopping Center:</u>	5. 1 4. 20 3. 30 2. 14 1. 7	Chi square = 33.08 d.f. = 4 P < .001	Question 15. <u>Clean Areas:</u>	5. 16 4. 27 3. 23 2. 6 1. 1	Chi square = 33.23 d.f. = 4 P < .001

Question 16. <u>Building Most Used:</u>	<u>Distribution</u>	<u>Chi Square Data</u>		Question 21. <u>Interact:</u>	<u>Distribution</u>	<u>Chi square Data</u>	
		N = 58	Chi square = .06			Chi square = 15.00	d.f. = 4
	Shopping Center 30				5. 17		
	Club 28				4. 23		
			d.f. = 1		3. 13		P < .01
			P < = not significant		2. 17		
					1. 3		
Question 17. <u>Most Popular Recreation:</u>	Drinking 31	N = 54					
	Football 18	Chi square = 18.78		Question 22. <u>Loss of Energy:</u>	1. 9	Chi square = 30.75	
	TV 5	d.f. = 1			2. 25	d.f. = 4	
		P < .001			3. 27	P < .001	
Question 18. <u>Singles and Families:</u>	5. 1	Chi square = 29.94			4. 8		
	4. 20	d.f. = 4			5. 4		
	3. 27	P < .001		Question 23. <u>Know People:</u>	5. 31	N = 68	
	2. 18				4. 17	Chi square = 36.25	
	1. 7				3. 10	d.f. = 4	
Question 19. <u>Time in the House:</u>	1. 24	Chi square = 10.07			2. 8	P < .001	
	2. 14	d.f. = 4			1. 2		
	3. 16	P < .05		Question 24. <u>Walk More:</u>	5. 31	Chi square = 30.48	
	4. 11				4. 16	d.f. = 4	
	5. 8				3. 11	P < .001	
Question 20. <u>Noise:</u>	1. 14	Chi square = 19.39			2. 13		
	2. 10	d.f. = 4			1. 2		
	3. 19	P < .001		Question 25. <u>Living:</u>	5. 22	Chi square = 20.48	
	4. 26				4. 15	d.f. = 4	
	5. 4				3. 24	P < .001	
					2. 8		
					1. 4		

<u>Distribution</u>		<u>Chi Square Data</u>	
Question 26. <u>Children Safe:</u>	5. 31	Chi square = 51.73	
	4. 27	d.f. = 4	
	3. 11	P < .001	
	2. 3		
	1. 1		
Question 27. <u>Climates:</u>	1. 4	N = 71	
	2. 10	Chi square = 39.21	
	3. 32	d.f. = 4	
	4. 20	P < .001	
	5. 5		
Question 28. <u>Playmates:</u>	5. 19	Chi square = 22.54	
	4. 24	d.f. = 4	
	3. 17	P < .001	
	2. 13		
	1. 0		
Question 29. <u>Places To Play:</u>	5. 14	Chi square = 18.83	
	4. 27	d.f. = 4	
	3. 16	P < .001	
	2. 12		
	1. 4		
Question 30. <u>Houses:</u>	5. 13	N = 71	
	4. 20	Chi square = 32.03	
	3. 29	d.f. = 4	
	2. 7	P < .001	
	1. 2		
<u>Distribution</u>		<u>Chi Square Data</u>	
Question 31. <u>Courtyards Private:</u>	5. 7	N = 56	
	4. 17	Chi square = 3.80	
	3. 10	d.f. = 4	
	2. 12	P < .70	
	1. 10	Not significant	
	No Courtyards 17		
Question 32. <u>Use Courtyards:</u>	5. 8	N = 71	
	4. 14	Chi square = 7.34	
	3. 15	d.f. = 4	
	2. 22	P < .20	
	1. 12	Not significant	
Question 33. <u>Suburban:</u>	5. 10	Chi square = 6.65	
	4. 17	d.f. = 4	
	3. 13	P < .30	
	2. 22	Not significant	
	1. 11		
Question 34. <u>Bland Interiors:</u>	1. 8	Chi square = 18.43	
	2. 9	d.f. = 4	
	3. 22	P < .01	
	4. 25		
	5. 9		

Question 35	<u>Inside Decorated:</u>	<u>Distribution</u>	<u>Chi Square Data</u>		
			N = 72	Chi square = 44.25	
		5.		d.f. = 4	
		4.		P < .001	
		3.			
		2.			
		1.			
Question 36. Windows:	<u>Windows:</u>	<u>Distribution</u>	<u>Chi Square Data</u>		
			N = 72	Chi square = 19.27	
		5.		d.f. = 4	
		4.		P < .001	
		3.			
		2.			
		1.			
Question 37. Plumbing:	<u>Plumbing:</u>	<u>Distribution</u>	<u>Chi Square Data</u>		
			N = 72	Chi square = 136.90	
		1.		d.f. = 4	
		2.		P < .001	
		3.			
		4.			
		5.			

## APPENDIX D

### DETAILED ANSWERS TO DESIGN HYPOTHESES

Hypothesis 1. There is no way to satisfy human needs in a one-company town. Responses to questions do not directly address this issue. The only questions that bear on it are those about groceries and having to go outside to buy necessities (questions 8 and 10). Most (56%) feel that Shay Gap is either worse than most or the worst of any. Yet, they do not feel they have to go outside to buy things more than in an average community. Whether this situation would be different if Shay Gap was not a one-company town is not possible to test.

Hypothesis 2. Company life is divided between the "haves" and "have nots." This hypothesis cannot be dismissed as it refers to the singles vs families. The singles feel that the majority of services are geared toward families, while the families often feel there are too many single men. The community was divided in opinion on this issue. 37% felt it was no better or worse than other communities they had lived in recently. 29% felt it was better than most, while 33% felt it was worse than most.

Hypothesis 3. An isolated community does not have to be like a normal community. Not tested.

Hypothesis 4. Women should have less fear (in Shay Gap) of children getting run over. This seems to be true for Shay Gap. Forty-two percent of the respondents feel Shay Gap is the safest for children of any place in which they had lived recently, while 37% feel it is safer than most. Only 5% have a negative response to this question (No. 26). No separation of residents by sex was made in analyzing this question.

Hypothesis 5. The fear of children being run over may be replaced by fear of the climate. Answers to question 27 indicate a tendency to feel Shay Gap is about average in this respect. A chi square test of the average hypothesis yield a chi square of 3.01, indicating there is no significant deviation from an average distribution (assuming a symmetrical distribution of scores as 5, 10, 43, 10, 5). Therefore it seems the fear of autos is not replaced by a fear of climate.

Hypothesis 6. A result of the car being kept away is increased interaction among people. Question 21 asks if residents feel they interact with more people at Shay Gap than any other place in which they have lived recently. The answers might seem to cluster around the "average" response, so testing against an average distribution of 5, 10, 43, 10, 5 yields a chi square of 72.33 which is highly significant with d.f. 4. Therefore, it is significantly different from an average response pattern. Fifty-five percent feel they interact with people at Shay Gap either more than they did at most places they have lived recently or more than they did at any place they have lived recently.

Probably more significant (question 23) that 65% of the residents felt they got to know more people at Shay Gap than at most other places they had lived recently.

Hypothesis 7. In a town with a population under 1,000, everyone recognizes everyone else. This was not directly testable, but 48% of Shay Gap's respondents came from rural areas and 52% came from urban backgrounds. Thus, when 42% (question 23) indicate they got to know more people at Shay Gap than at any other place lived recently, this would seem to be more specific to Shay Gap than to communities in general under 1,000. If the answers to this question are separated by rural vs urban backgrounds, the distribution of scores is almost identical. (Rural: 1-0, 2-4, 3-5, 4-8, 5-14; urban: 1-2, 2-4, 3-5, 4-9, 5-17).

Hypothesis 8. People want to walk more at Shay Gap than elsewhere. This hypothesis could not be tested, but more to the point: did people walk more at Shay Gap? In answering question 24, 64% felt they walked either more than most places or the most of any place.

Hypothesis 9. There are four levels of territoriality. This hypothesis should really have been stated as four levels of privacy, and, as such, it was tested with subjects ranking the four levels of private-to-public spaces pretty much in the order expected. No questions about territory as a concept were implied. (See page 20 for details of the ranking).

Hypothesis 10. The school should be the crucible of the community. As it was finally placed, the school was not able to be a central focal point. Considering the attraction of the shopping center and the club, it is doubtful the school would have functioned much better. The school did function (see page 34) as the place where friendships were established for children.

Hypothesis 11. Children bring families together. This is a common observation of urban life, but no evidence was collected to support this hypothesis in Shay Gap. There was no discernible relationship between children playing together and their parents' visiting. Since the primary children friendships seemed to be school related, there was also no evidence that children brought adult neighbors closer.

Hypothesis 12. The school has to be a community building. There was not much evidence that the school functioned well as a community building, probably because the school is located at the edge of the community, and because most social and community activities take place in other buildings.

Hypothesis 13. There is no difference between an open and closed town. This is related to the "company town" syndrome where the town is closed to persons not working in the company-owned enterprise. It was not possible to test this hypothesis based on present data.

Hypothesis 14. Single men quarters should be mixed with family. There seemed to be general agreement that relationship between single people and families was about average. Yet, there were a few singles living on the edge of the family housing. These few (N=3) did not feel relations were different from average. Single people generally expressed some discomfort, feeling the company was geared more toward married couples.

Hypothesis 15. Separating single men from families creates suspicion. This would seem to be true from U.S. military studies (Bechtel and Ledbetter 1976). It also seemed that there was less suspicion in Nanisivik, a Canadian mining town that mixed singles with married in housing (Bechtel and Ledbetter 1980). However, data collected from Shay Gap did not bear directly on this question.

Hypothesis 16. In the desert of Australia, men lose their libidos in three months. There did seem to be some tendency to feel that there was a greater loss of energy in Shay Gap than in most places. (question 22). Whether this directly related to libido is not clear.

Hypothesis 17. There are too many single men now in Shay Gap. This was a comment picked up by some of the families, but data do not suggest a majority opinion. Shay Gap was originally planned for 110, but now has 200 single men.

Hypothesis 18. All services should be placed at a focal point. Question 16 makes it clear that the shopping center was perceived as the most used building in Shay Gap, but there is no statistical difference from perceived use of the club. Also, the outdoor theatre actually had over five times more man hours than did the shopping center. Nevertheless, the shopping center did function well as a focal point and social center. Observation showed it was the place most accessible to every member of the community and the amenities there were an excuse for attendance.

Hypothesis 19. Grouping too many services in one place does not work. From the data on hypothesis 38, it would seem the shopping center was a qualified success. It was not an outstanding success because 41% considered it average, 30% considered it better than average, and 29% considered it worse than average (question 11).

Hypothesis 20. Houses were too close in Shay Gap. While question 9 showed that residents perceived the houses in Shay Gap were closer together than in any other place they had lived recently, the noise (question 20) did not seem to be a serious problem. It is difficult to tell whether houses were in fact too close.

Hypothesis 21. People want a horizon. Data bearing on this hypothesis were already addressed in answering hypothesis 1. A majority prefer hills (63%), and only 3% said they prefer a horizon.

Hypothesis 22. Residents cannot have a party without neighbors hearing. This would certainly be true if the party was held in the courtyards. However, question 20 indicates noise (including parties) was not a problem for most.



Hypothesis 23. Most people would rather be in an air conditioned home or in a bar drinking. It is not clear from this hypothesis what the other alternatives would be. However, from the fact that people did perceive they spent more time indoors at Shay Gap (question 19) and the fact that drinking is recognized as the most important form of recreation (question 17), it might seem that this hypothesis is largely confirmed. Yet, the large number of man hours in the outdoor theatre, where the atmosphere is hardly air conditioned (cold in winter, stifling in summer) indicates that the actual behavior belies the perception of residents.

Hypothesis 24. Closing down the community in 1980 gives a temporary aspect to the community. The answers to question 7 would tend to confirm this hypothesis. Almost half (46.5%) perceive Shay Gap to be the least permanent of any community in which they have lived while another 13.6% see it as less permanent than most.

Hypothesis 25. The hills create a feeling of confinement (or security). On the design questionnaire, this is question 1. Forty-six percent regard the hills as comforting and protective while 19 (26%) regard them as pleasant. A majority (63%) prefer hills to an open horizon. Only 3% said they prefer a horizon to hills. While these responses do not confirm that the hills create a feeling of comfort and protection in a majority of residents, a clear majority does prefer hills over a horizon for a view. About a quarter (24.6%) feel that Shay Gap is no different from a town without hills. Only 3% said they felt uncomfortable or confined. Thus, while the basic hypothesis that the hills would create a feeling of security in most was not confirmed, the basic premise that people prefer hills over a horizon was confirmed.

Hypothesis 26. Houses at Shay Gap exceeds the norm for single family housing. This hypothesis was proven. Question 30 shows that 40% feel the houses are average in looks, while 45% feel they are better than most or the best looking of any place in which they have lived. In question 33, which asks whether Shay Gap houses are like a suburban single family house, there is a minority tendency to feel that they do not (45%), while 55% feel that they are average or better.

Hypothesis 27. The townsite is too small. Whether it is too small or not is uncertain, but 60% feel there is less space than most or the least space of any town they have lived in recently. There is a strong feeling that there is not enough space for exercising pets (55%) or for outdoor storage space (61%). It still remains questionable whether the lack of spaces is caused by the size of the townsite or by the deliberate crowding of the houses. The latter is the more likely explanation since there is still room on the site for playing fields and open areas.

Hypothesis 28. There has to be a minimal number of people before satisfactory services can occur. Not tested.

Hypothesis 29. The noisy plumbing in Shay Gap invades privacy. More than any other question, residents agreed (74%) that the plumbing at Shay Gap was the noisiest they had ever experienced. However, the researchers did not pick up any indication from the interviews that this was an invasion of privacy. No one indicated it was an issue worth attacking. Most answered this question in a humorous vein.

Hypothesis 30. Inability to open windows is a problem. This question was not asked directly, but only a minority of residents (3%) did indicate that they would like to be able to open windows.

Hypothesis 31. There is no satisfactory place to repair a car. From what we observed, this is not true. Residents were seen repairing their cars in the marginal areas. Some were more enterprising than others in rigging apparatus for car repair.

Hypothesis 32. The house must be an integral part of the community, designed from the community viewpoint. No attempt was made to test this proposition directly, and it is not clear how one would test it. Yet, the uniformity of housing design in Shay Gap did not produce rejection on the part of the residents. In all the questions about housing design or the interior, the results show Shay Gap was no worse than average and in some cases better. Thus, while we cannot test the hypothesis directly, if the designer subordinated the housing design to the community design, it did not produce a negative response in the residents.

Hypothesis 33. The community should be far enough from the mine not to create a dust problem. The ore at the mine is exposed with explosives. Figure D-1 shows a typical mining explosion, and gives an idea of the amount of dust produced. The hypothesis was confirmed with qualifications. There was some tendency to feel that dust was not a problem. In question 3, 60% felt it was either better than most or the best of any place in which they had lived recently. This was clearly the case when one observes, by comparison, the precautions that need to be taken at the town of Goldsworthy where dust is an ever present problem.

Hypothesis 34. The community should be sheltered from the wind and blowing sand. While 49% felt Shay Gap was better than average, 30% thought it was just average and 20% felt it was worse than average. This is a slightly favorable trend but not an overwhelming one. Perhaps there is no way to completely shelter a community from the winds in the Pilbara.

Hypothesis 35. People have a need to be enclosed. There is no evidence to support this, but there is evidence that most residents prefer the hills (63%). Forty-seven percent do find the hills comforting and protective. Perhaps at least some people need to be comforted and protected.

Hypothesis 36. Cars can be kept from houses without problems. Just how "problems" is defined is critical in testing this hypothesis. Some residents complained of having to carry groceries from the car, yet even the singles interviewed recognized the benefit in safety to children. The "problems" that surfaced are minor.



Figure D-1. Typical mining explosions, showing the amount of dust produced.

Hypothesis 37. All activities should take place within screened areas. This appears not to be true in some cases, and to be true in others. The setting with the largest number of man hours, the theatre, was outdoors. Other concentrations of activity such as the club and shopping center were indoors. If one wants to specify daylight activities, then a great majority of activities take place indoors. The theatre, which operates at night, is outdoors.

The reason for trying to get all activities behind screens is the predominance of flies during daylight hours. One of the folk traditions of Western Australia is the Western Australian "salute", a wave of the hand to brush away flies. Thus, this principle is partly confirmed in daylight hours, but even then, not completely. Children still play outdoors and unscreened during the day.

Hypothesis 38. There is no problem in having all houses be identical. Of course, all houses were not identical. Some had two floors, others only one. The outside landscaping would often conceal house lines. Certainly, the houses looked more alike than individually designed houses would have, but with present data, it is not possible to test if they were really more identical than a series of tract houses. Most residents did not feel the houses were identical, but no data were collected.

Hypothesis 39. Children will play in undefined areas, not playgrounds. The most that can be said about this issue is that children were observed

playing everywhere, open areas and playgrounds. Since there were more open areas than playgrounds, they probably play more in open areas, but there is no evidence they preferred the open areas to the playgrounds. Forty-four children were stopped at random and asked where they played. Their answers were as follows:

Everywhere	19
Courtyards	8
Oval	4
Store	8
House	6

This clearly indicates no preferences related to playgrounds, and it does seem that children feel free to play wherever they choose. Some residents complained that there should have been more playground equipment. It is also true that what playground equipment was available was constantly in use.

Hypothesis 40. All openings face the courtyard. Residents should be able to look out but outsiders should not be able to look in. There was some feeling that windows provided privacy (question 36), but residents were divided over whether the courtyards themselves were private (question 31). Tentatively, it would seem the window placement does provide privacy.

Hypothesis 41. All windows and houses face center of cluster. Virtually every resident interviewed was aware of the cluster to which his dwelling belonged. However, no data bore on whether residents were aware that their houses and windows faced the center of the cluster.

Hypothesis 42. Bland interiors enable people to express personality. There was a tendency to recognize that interiors were bland (question 34), but most also felt that the interiors were easily decorated (question 35). Data and observations tend to support this hypothesis and the bland interior was also successful in Iran (Bechtel 1975) and Saudi Arabia (Bechtel 1976).

Hypothesis 43. Houses receive two shades per day from the overhang. This may or may not be true in fact, but residents perceived more shade coming from vegetation (question 5), and did perceive a little more shade in Shay Gap than in other places they had lived recently.

Hypothesis 44. Women will confine themselves to air conditioned areas. There was a tendency for both males and females to say they spent more time in the house (question 19) than in any community in which they had recently lived. It is not clear this was directly related to air conditioning.

Hypothesis 45. There was too much noise within each cluster. Answers to question 20 suggest that while a few did feel there was too much noise (33%), 51% did not feel so, and 26% felt it was just average. Thus, about two thirds did not feel noise was a problem and one third did. It may be that certain locations were noisier. Residents who felt the noise was the worst of any place in which they had lived tended to live in the single quarters or the flats, not in the family housing area. Hypothesis 45 is not confirmed.

Hypothesis 46. People do not feel crowded because they are in the desert. From the answer to question 9, 60% did feel houses were closest together of any place they had lived recently. Whether this perception

would be expressed in terms of the hypothesis is unanswerable from the data. From question 4, it appears that most residents also feel the town is smaller than most places where they had lived recently (60%). There is some evidence that residents perceive the town's population density but do not attach the negative sense of "crowded" to it.

Hypothesis 47. Shay Gap is the end of the line. People feel cut off from the main stream. Question 6 indicates that 51% do feel Shay Gap is the most isolated community in which they have lived. This hypothesis tends to be confirmed.

Hypothesis 48. The clean areas of Shay Gap are noticeably different. Answers to question 15 indicated the clean areas of Shay Gap seemed to be better than most places to 59% of the residents.

Hypothesis 49. Clean areas will be inconvenient. No data bear on this directly. It would seem, from respondents' comments that the most favorable aspect of the clean areas was that they were observed and working men did not enter them in grimy clothes. The working men did not remark about the clean areas as causing them any inconvenience.

Hypothesis 50. Residents will not like the housing design. Some residents remarked that the houses and buildings did look "ship like" or "from outer space." However, 45% of residents thought the houses were at least better than most places, 40% felt they were average, and only 12% regarded them unfavorably (question 30). On the other hand, residents do not regard the houses as equal to suburban single family houses. Question 33 shows 45% feel they are below a suburban standard and 37% feel they are above an urban standard. The hypothesis is not confirmed. People do seem to react favorably to the design as a whole.

Hypothesis 51. The sliding front door is a problem. No direct question was asked about the front door, but residents were asked to respond to areas they felt were problems, and none mentioned the front door. The hypothesis was not confirmed.

Hypothesis 52. The lack of a tub is inconvenient. No respondents pointed to the shower as a problem. No questions were asked about it directly.

Hypothesis 53. There is not enough space for pets. 54.8% did not feel there was enough space for pets at Shay Gap, compared to places they had lived recently (question 12). Only 19% felt space was better than most places, while 26% felt the space for pets was average.

Hypothesis 54. There is not enough space for gardens. Residents were somewhat inclined to feel the space for gardens in Shay Gap was less than that in most communities (43.8%). Thirty percent felt it was average, and 27% felt it was at least better than most places (question 14).

Hypothesis 55. Outdoor and indoor storage is inadequate. Residents felt there was a tendency not to have sufficient outdoor space compared to most places (49%). Only 13.7% felt there was sufficient space (question 13).

Indoor space for storage fared better. More than half (57.5%) felt the indoor storage space was at least better than most places, while only 19% felt it was worse than most places.

#### SUMMARY

The 55 design hypotheses were listed as belonging to one of three categories: 1) lacking sufficient data to see any trend, 2) having enough data to see a confirming trend, and 3) having enough data to show a disproving trend. The trend was interpreted as favoring or not favoring Shay Gap as a design success. Thus, negative hypothesis that were not confirmed favored Shay Gap. Of course, certain hypotheses were not really design hypotheses, as such. For example, hypothesis 1, there is no way to satisfy human needs in a one-company town, does not reflect the design adequacy of Shay Gap. These hypotheses were usually ignored in data gathering. The remaining hypotheses were seen as reflecting positively or negatively on the design of Shay Gap and were scored accordingly as favorable or unfavorable.

Of the 55 hypotheses, only 41 had sufficient data to be included in the favorable or unfavorable columns. Of these, 22 were favorable and 15 were unfavorable. Thus, the final score is 63.4% favorable to 36.5% unfavorable. But this treats each hypothesis as being equal in importance, which is not true. For example, keeping children safe from injuries by automobile is more important than providing windows that open.

One could adopt the posture that one critical hypothesis in each of the design categories of site selection, community design, house design, and interior design was central. For site selection, the choice of a location with hills was critical. For community design, the decision to exclude automobiles was most critical. For house design, the configuration portrayed really covered several decisions, but these can be lumped together as one design format. For interiors, the bland interior was the most critical decision. Each of these most critical decisions were essentially confirmed by the data.

The fifteen design decisions that were disconfirmed were minor by comparison. The school is the most major issue. Two hypotheses account for it (25 and 27). Of the remaining issues, the closeness of houses and smallness of site were important but not clearly negative.

The conclusion is that the community of Shay Gap is a qualified design success.